Vol. 2

NELP
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bulletin

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Special Cleanup Edition

Our mission

The Navy Environmental Leadership Program (NELP) was established to find new and innovative ways to manage Navy environmental programs. It includes a West Coast base at Naval Air Station (NAS) North Island and an East Coast base at Naval Station (NAVSTA) Mayport.

The NELP mission includes testing new technologies and management strategies then sharing successes throughout the Navy and Marine Corps. NELP's ultimate goal is to preserve the environment by accelerating cleanups and exporting cost-effective and time-efficient technologies to other naval facilities.

The cleanup process has been an integral part of NELP from its establishment. The NELP cleanup program goals are to:

- identify and test innovative environmental cleanup technologies
- develop partnerships with government agencies and innovative technology programs
- involve federal, state, and local entities in the cleanup process
- share successes with other naval bases and marine corps
- reduce risks to human health and the environment
- plan for the future
- save time and money

Under the NELP environmental cleanup program, the Navy is making significant progress in realizing its goals. This NELP Bulletin focuses on environmental cleanup initiatives that have been completed, are currently underway, or are planned at NAVSTA Mayport and NAS North Island.

Low Flow Sampling

Saving money and attaining more reliable data at NAVSTA Mayport

When conventional groundwater sampling methods produced questionable results, the Fleet Industrial Supply Center (FISC) Fuel Farm at NAVSTA Mayport turned to low flow purging and sampling technology to produce more accurate and reliable data as well as cost savings.

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VOC Off-Gas Treatment Technologies

Researching made easy for RPMs

The Navy has successfully integrated its Installation Restoration (IR) program efforts with that of its Research and Development (R&D) program. This innovative approach was proposed by the Navy's Alternative Restoration Technology Team (ARTT) in January 1997 and has already been successfully implemented at NAS North Island in two steps. The first step was to demonstrate innovative volatile organic compound (VOC) off-gas treatment technologies at NAS North Island. The second step was to create a searchable database tool for remedial project managers (RPM) to select the most time-efficient and cost-effective VOC off-gas treatment technology suitable for site-specific remediation projects. The implementation of these steps has been a leap forward in connecting efforts between the IR and R&D programs for the environmental cleanup process.

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A glance at what's in this issue

Low Flow Sampling

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In June 1997, seven groundwater monitoring wells at the site were sampled for lead, using conventional bailing methods. The lead concentrations in the seven samples ranged from 12 to 59 parts per billion (ppb), and six of the seven samples were above the Florida groundwater cleanup target level for lead, which is 15 ppb (FAC 62-770.680).

"The lead concentration outcome was so out of the norm that I knew something must have happened during the sampling process to skew the results," Cheryl Mitchell, NAVSTA Mayport Environmental Director, said. "So I recommended that the technicians go back out to collect a second set of samples using the low flow method."

On Mitchell's recommendation, the wells were resampled in October 1997 using low flow purging and sampling methods. All of the groundwater samples collected during this event had lead concentrations below the laboratory detection limit of 5 ppb.

According to Mitchell and Installation Restoration Program Manager Randy Bishop, it is quite possible that the lower and probably more accurate lead concentrations were a direct result of the low flow purging and sampling methods that were used to obtain the groundwater samples.

"When you do the normal bailing procedure, it causes disturbance and sediments get stirred up, throwing samples off," Bishop said. "If anything, it tends to make the results higher, so that you don't get a true accounting of what the situation is."

Before collecting a groundwater sample from a monitoring well, it is conventional practice to purge the well until the stagnant water is removed. Purging usually is performed until indicator parameters such as pH, conductivity, temperature, and turbidity stabilize. Conventional purging methods include bailing and/or pumping with a submersible groundwater pump.

An alternative to conventional purging and sampling methods, low flow groundwater purging and sampling is a process in which groundwater is purged from the monitoring well at extremely low flow rates, causing little or no agitation of the groundwater in the well. The low flow purging and sampling often removes groundwater from the well at a rate slower than the well recharge rate, resulting in minimal mixing of the stagnant groundwater with the representative groundwater flowing into the well.

Microwells are used for low flow sampling and are easily drilled and constructed.

Both bailing and pumping cause some aeration of the groundwater, which can result in reduced concentrations of volatile organic compounds (VOC) in the samples. These methods can also artificially increase the turbidity of the sample above the true groundwater turbidity by agitating solids that have settled out of the stagnant groundwater into the bottom of the monitoring well. The increase in turbidity may result in artificially high concentrations of inorganic constituents in the groundwater, depending on the composition of the solids that were present in the bottom of the monitoring well. The advantage of low flow purging and sampling is minimal aeration and/or agitation of the groundwater, due to the passive method by which the well is purged. For this reason, samples obtained by this method are more representative of the true groundwater quality than are those collected by conventional methods.

According to Mitchell, low flow sampling techniques can result in significant cost savings on projects that require groundwater sampling. Low flow purging and sampling results in lower volumes of purge water than conventional purging methods because it minimizes the recovery of stagnant well water by stabilizing turbidity faster due to less disturbance, while maximizing the recovery of representative groundwater from the aquifer. The end result is a cost savings because fewer drums of contaminated purge water have to be disposed.

"The water taken out during sampling or installation of wells has to be collected, and it's called investigation-derived waste [IDW]," Bishop said. "The water is placed in containers, and, based on the sample results that we get, we'll dispose of it accordingly. If it's clean water, we can just pour it right back on the site. If it contains hazardous constituents, it must be disposed of in accordance with regulations. Low flow reduces the amount of IDW generated."

The greatest benefit of the low flow purging and sampling technique, however, is a direct result of the more reliable data that it can obtain. A typical example of a cost savings resulting from using low flow purging and sampling would be on a site in which conventional sampling methods create artificially low VOC concentrations in the groundwater samples due to aeration that occurs during purging. In this case, the remediation equipment specified in the remedial design may be undersized, costing thousands of dollars to upgrade or replace once the actual VOC concentrations are obtained.

Another example would be at a site where conventional purging and sampling methods yield artificially high inorganic concentrations in the groundwater due to the increased turbidity caused by agitation during purging. In this case, hundreds of thousands of dollars might be spent trying to remediate contamination that does not exist. "Low flow sampling may have prevented this from happening at the Fuel Farm last year," Mitchell said.

"Both the EPA and the state of Florida want people to use the low flow procedure," Bishop said. After experiencing the benefits of low flow firsthand, FISC employees will not hesitate to request this method of investigation in the future.

For more information about low flow sampling contact NAVSTA Mayport Environmental Director Cheryl Mitchell at (904) 270-6730 or e-mail cmitchel@mail.pwcjax.navy.mil or contact Installation Restoration Program Manager Randy Bishop at (904) 270-6730 or e-mail rbishop@mail.pwcjax.navy.mil.

Colloidal Borescope Technology

Groundwater flow characterized in minutes at NAS North Island

The Navy has taken a proactive role under NELP to identify innovative technologies that will save time and money. A partnership between the Oak Ridge National Laboratory Environmental Technology Section (ORNL/ETS) and the Navy promotes the development and demonstration of innovative technologies at NAS North Island. The colloidal borescope technology, developed by ORNL/ETS, is an example of an innovative environmental cleanup technology that has been successfully demonstrated *in situ* at NAS North Island and has proven to be time-efficient and cost-effective.

The colloidal borescope measures groundwater velocity and direction in the field, or *in situ*. Components of the colloidal borescope include two charge-couple device cameras, an optical magnification lens, an illumination source, a ball compass, and a water-tight stainless steel housing. The dimensions of the colloidal borescope range from 60 to 89 centimeters in length and 44 millimeters in diameter and can be inserted into a 5-centimeter-diameter or larger monitoring well.

How does the colloidal borescope work? The colloidal borescope is attached to a cable and lowered into a monitoring well. Upon insertion into the well, an electronic image magnified at 140X is transmitted through the cable to the surface, where it is viewed and analyzed on a high-resolution monitor and frame grabber computer. In the monitoring well, the borescope is aligned using a compass that is viewed by one of the charge-couple device cameras. As particles in the groundwater pass beneath the lens under the borescope, the back lighting source illuminates the particles. A video frame grabber digitizes individual video frames at intervals selected by the operator.

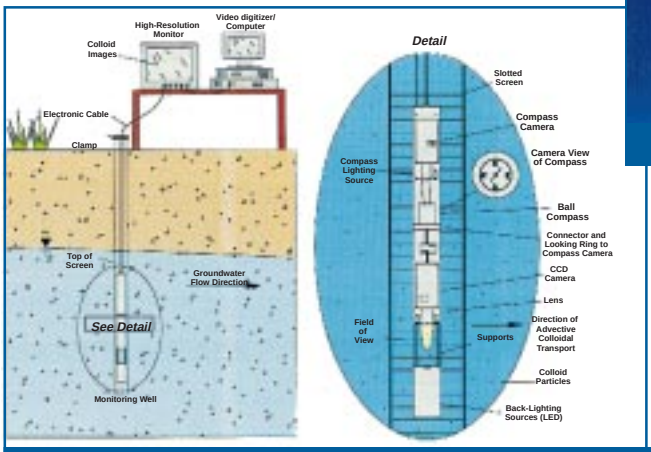
At this point, software developed by ORNL compares the two digitized video frames to match particles and assign a pixel address to each particle. With this information, the software program computes and records the average particle size, number of particles, speed, and direction. The use of a compatible computer allows for groundwater flow measurements to be analyzed every four seconds. After only a few minutes of observations, a large database is created, and groundwater flow and direction can be determined.

The colloidal borescope has been tested twice at NAS North Island. In October 1997, five monitoring wells were selected for groundwater flow characterization. Of the five wells investigated, a reliable flow measurement was obtained from one of the monitoring wells. At this particular monitoring well, over five hours of data were collected to determine the direction of the groundwater flow and average velocity per day. The flow measurements taken at the other four monitoring wells did not yield reliable flow measurements. ORNL believes that several factors, including a vertical flow component in the well, variability in groundwater flow zones, and clogged well screens that restricted the flow of groundwater to the wells, may explain the unreliable flow measurement results.

In March 1998, a modified colloidal borescope was used to characterize groundwater flow in the same five monitoring wells. Specially developed packers were used to isolate test zones and minimize vertical flow in the monitoring wells. No preferential flow zones were identified at three of the five monitoring wells. Reliable flow measurements were observed at the other two of the five monitoring wells tested. Both of these monitoring wells demonstrated a west-southwest flow direction that was consistent with a contaminant plume and earlier observations.

As a result of the success achieved with the use of the colloidal borescope technology for groundwater flow characterization, the Navy will continue to work closely with ORNL to implement this technology at other NAS North Island sites as part of the Navy's environmental cleanup program.

A colloidal borescope.



A cross section diagram that identifies the various parts of the colloidal borescope technology in a monitoring well.

Advantages to Using the Colloidal Borescope

- Provides *in situ* groundwater flow measurements
- Uses measuring equipment that can be inserted in existing wells at least 5 centimeters in diameter
- Uses pre-existing wells, avoiding the costs of additional well installation
- Creates a large database for flow measurements after only minutes
- Allows for more data to be collected in a shorter period of time than conventional methods
- Provides validation of groundwater modeling by conducting several measurements at the site
- Provides a time-efficient and cost-effective option for groundwater flow

For more information, contact Mr. Frank Gardner, ORNL/ETS, at (970) 248-6238 or e-mail fgg@ornl.gov.

VOC Off-Gas Treatment Technologies

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Installation Restoration (IR) Site 9, where three VOC off-gas technologies were demonstrated at NAS North Island, CA.

Three VOC off-gas treatment technologies were used to treat off-gas at IR Site 9. The first of the three technologies consisted of carbon adsorption with on-site steam regeneration. The second VOC off-gas treatment technology was part of a NELP project at IR Site 9 using a NoVOCs™ in-well stripping system developed by MACTEC Inc. This project used the Thermatrix flameless oxidation process for the VOC off-gas treatment. As part of ARTT's efforts, a third VOC off-gas treatment technology was demonstrated by Process Technology, Inc. (PTI) using an ultraviolet (UV) oxidation system.

The UV oxidation system by PTI consisted of a fluidized bed concentration unit and a photolytic destruction unit (PDU). This treatment technology was tested on a slip-stream from the soil vapor extraction off-gas at IR Site 9. The slip-stream that was used was discharged back into the carbon adsorption system with no new waste streams generated. The preliminary results indicated a reduction in VOC concentrations to below the maximum allowable emissions. The overall average total VOC destruction and removal efficiency was 95.4 percent. An estimate of the unit cost to implement this technology at IR Site 9 for a 3,000 standard cubic feet per minute (scfm) was $3.77 per pound of VOC treated. The Navy used the Naval Facilities Engineering Service Center (NFESC) Broad Agency Announcement (BAA) process and a unique contracting approach to fast-track the PTI demonstration, save money, and reduce risk to the Navy (see text box).

In implementing the second step, the searchable database for RPMs, all data from the VOC off-gas treatment technology demonstrations were collected and entered into a database. NFESC added pertinent data from a comprehensive literature search of all available proven VOC off-gas treatment technologies. Cost and performance information on VOC off-gas treatment technologies was also added to the database. The database contains a built-in unit cost estimator for calculating unit treatment costs in dollars per pound of VOC treated and two graphic-based screening tools. The screening tools allow RPMs to (1) display each treatment technology and associated commercial configurations and rates according to 13 different criteria, and (2) analyze, synthesize, and justify complex decisions and evaluations. This database will continue to be updated and maintained as NFESC obtains more information on VOC off-gas treatment technologies for environmental cleanup projects.

This innovative approach to integrating IR and R&D efforts has proven to be a great success at NAS North Island. ARTT is implementing this approach by supporting other Navy projects across the country each year. The VOC off-gas treatment technologies demonstration and comparison is another example of the Navy's long-term commitment to promote and develop innovative approaches that save time and money and that can be used to plan for the future in environmental cleanup.

For more information on this project, contact
Mr. Richard G. Mach Jr., Coronado Complex RPM,
SOUTHWESTDIVNAVFACENGCOM, at (619) 556-9934
or e-mail rgmach@efdswest.navfac.navy.mil.

A close-up of the Thermatrix VOC off-gas treatment system at IR Site 9.

The PTI technology demonstration shows the success of the Naval Facilities Engineering Service Center (NFESC) Broad Agency Announcement (BAA) process and other contracting mechanisms in saving time and money.

- PTI technology demonstration project showed good match of need and capability; R&D program managers approved the project in April 1997.
- PTI project underwent NFESC BAA process, where the technology was reviewed and approved by a team of engineers and scientists. Once approved by the team, a project can be contracted as long as it meets Federal Acquisition Regulation requirements.
- PTI was already an approved vendor to the Navy through the BAA, which reduced the time required to acquire a contract. The PTI contract was awarded in June 1997.
- Project team used innovative contracting mechanisms to fast track and reduce the government's risk regarding the success of the project.
- Project team opted for a combined fixed price and fixed unit price contract to increase incentive and minimize risk. The Navy agreed to pay for all mobilization, demobilization, work plan, report, and sampling requirements on a fixed price basis and all field work on a negotiated unit price basis. PTI was paid a unit price per pound of VOC off-gas successfully treated.
- Project team held over-the-shoulder review meetings, to shorten work plan preparation time, which saved 3 months of the project duration. The work plan was approved in September 1997.
- Field activities commenced in October 1997 and were completed in February 1998. The technology evaluation report was completed in May 1998.
- The fixed unit price contracting mechanism saved the Navy $60,000 on the demonstration project. The contract was originally awarded with a limitation of cost of $150,000. Based on the calculated mass treated by the PTI system, a contract deductive modification of $60,000 was awarded in April 1998, allowing these funds to be used on another project.

Pilot Technical Assistance for Public Participation (TAPP) Program

Pilot TAPP program supports community involvement in the environmental cleanup process

At NAS North Island, the Navy is encouraging community involvement through the Technical Assistance for Public Participation (TAPP) program. The Department of Defense (DoD) TAPP Program allows community members to receive independent technical assistance in interpreting scientific and engineering data related to environmental restoration activities at a military installation. With the help of the TAPP program, community members can play a more active and informed role in providing advice to the Navy on cleanup program plans. NAS North Island is the first DoD installation to implement the TAPP program.

The DoD TAPP program came about as a result of community members' need for independent analysis of cleanup plans and documents. NAS North Island provided many different resources to provide information to the community; however, the community preferred to pursue other avenues for support. The U.S. Environmental Protection Agency (EPA) provided limited assistance in 1996 through its Technical Outreach Services for Communities (TOSC) program, but more help was needed to address the vast number of technically complex projects being conducted at NAS North Island.

In response, the Navy at NAS North Island implemented a pilot TAPP program based on the TAPP rule being developed by DoD (the final TAPP Rule was published in the Federal Register Volume 63, Number 22 on February 2, 1998). Southwest Division, Naval Facilities Engineering Command awarded four contracts totaling $22,423 to small independent firms that could provide technical expertise to the installation's Restoration Advisory Board (RAB). DoD requires the formation of a RAB in a community where cleanup activities are to take place. The RAB is made up of concerned community members and officials of the affected military facility. The RAB meets regularly and provides an open forum where cleanup goals can be discussed and where community members can provide advice on the direction of the installation's environmental restoration program.

During the NAS North Island RAB meetings, the independent firms provided review and analysis in four areas including (1) a health risk assessment for a soil vapor extraction project, (2) investigation and cleanup of a former chemical waste disposal area near San Diego Bay, (3) studies and Navy recommendations for shoreline sediments, and (4) slag contamination along parts of NAS North Island's shoreline.

Community members play an active role in helping the Navy direct its cleanup efforts as part of the Technical Assistance for Public Participation (TAPP) program.

The independent technical review of Navy Cleanup documents enabled RAB members to provide informed input to the Navy on very complex technical issues.

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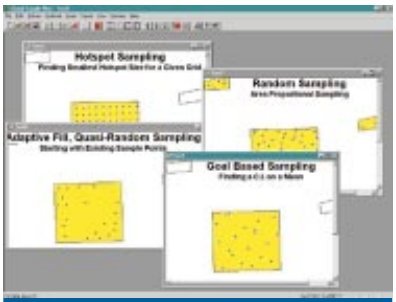
Visual Sample Plan Software

Saves time and money at NAS North Island

Field sampling is one of the first steps in the cleanup process, and the sampling results are critical as they are used to characterize the extent of contamination at a site. Designing and implementing a field sampling plan can be a drawn out and costly process, but thanks to a new computer program recently tested by the Navy, the process has been made easier.

The new software, called Visual Sample Plan (VSP), was developed by the Oak Ridge National Laboratory Environmental Technology Section (ORNL/ETS) and was recently tested and implemented by the Southwest Division Naval Facilities Engineering Command. The software is a product of the ORNL/ETS Visual Environmental Statistics Project (VESP), which seeks solutions to real-world environmental contamination problems using state-of-the-art statistical methods. With VSP, the Navy can develop sampling plans that are cost-effective, simple, accurate, and defensible.



A screen shot from VSP software program.

The VSP can be used for very simple tasks, such as plotting five random points in a square, while also offering more sophisticated options. The software allows the user to choose between different sampling schemes such as grid, hot spot, and random point sampling. It also provides immediate feedback on the accuracy and cost of a sampling event for each sampling scenario. The user interface is friendly and intuitive because it allows the use of site maps and building plans.

The VSP software was recently used to develop a sampling plan for a remedial investigation of a shoreline area at NAS North Island. As the investigation progressed, statisticians, software programmers, and project engineers collaborated to improve the software with actual field-tested results. Regulators were pleased with the statistical approach and the fact that the software was specifically designed to work with the U.S. Environmental Protection Agency data quality objective process.

The VSP software is an example of the Navy's commitment to finding solutions to expedite the cleanup process. The Navy will continue this mission by supporting programs like VESP. Look for a version 1.0 release of the VSP software in 1999.

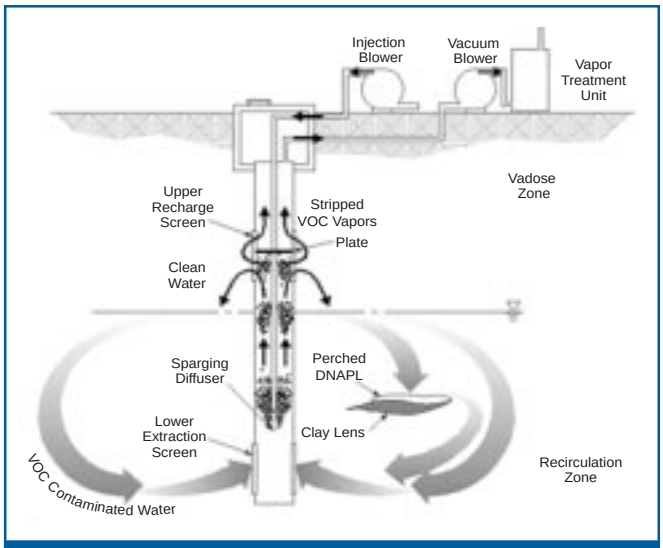
For more information or a demonstration copy of the VSP software, contact Mr. John Wilson, ORNL/ETS, at (970) 248-6198 or e-mail wu6@ornl.gov.

NoVOCs™ In-Well Stripping Technology

NELP demonstrates NoVOCs™ system at NAS North Island

NELP, in partnership with the U.S. Environmental Protection Agency (EPA) Superfund Innovative Technology Evaluation (SITE) program and Clean Sites Public/Private Partners, is demonstrating the NoVOCs™ system at NAS North Island Installation Restoration (IR) Site 9. The NoVOCs™ technology is an *in situ* groundwater remediation technology that combines air-lift pumping and air stripping to remediate groundwater contaminated with volatile organic compounds (VOC).

The NoVOCs™ system installed at NAS North Island consists of a single well with two hydraulically separated screened intervals installed within a single permeable zone. The air-lift pumping occurs in response to air introduced into the saturated zone by a blower. The air is discharged through an air diffuser approximately 10 feet below the static groundwater level, causing air bubbles to form in the water column in the well. The rising air bubbles provide the air-lift pump effect that moves water towards the top of the well and draws water into the lower screened section of the well. As the air bubbles rise through the water column, VOCs are transferred from the aqueous to the gas phase. The treated groundwater rises to a deflector plate and is forced out of the upper screen and back into the aquifer. The stripped VOC vapors are removed from the subsurface by a vacuum applied to the upper well casing and are then treated by a Thermatrix flameless oxidation process at the surface.



A cross section diagram of how the NoVOCs™ in-well stripping technology works.

The NoVOCs™ in-well stripping technology at Installation Restoration (IR) Site 9.

The NoVOCs™ technology demonstration is evaluating the reduction of VOC concentrations in the groundwater discharged from the treatment system, the radial extent of the NoVOCs™ treatment cell, and the mass of VOC removed by the system during the demonstration.

The demonstration program objectives are being achieved by collecting 12 groundwater samples and 4 air samples from the NoVOCs™ well and surrounding wells. The baseline and long-term sampling, two of three data collection phases, occur before system startup and monthly during the demonstration. The third data collection phase to be implemented is the dye tracer sampling. This sampling plan evaluates the radial extent of groundwater treatment by monitoring groundwater for the presence of dye. The sampling plans have been hampered several times as a result of operational difficulties.

The NoVOCs™ system has been in intermittent operation from April 1998. Demonstration samples collected during the first month of operation indicated that VOC concentrations in groundwater discharged by the NoVOCs™ system were reduced by greater than 90 percent. However, after the first month of operation, the NoVOCs™ system experienced operational difficulties; specifically, pumping rates within the well were significantly lower than designed. To determine the cause of the decrease in pumping rates, a series of studies were conducted to evaluate biofouling and iron precipitation in the well, hydrogeologic characteristics of the upper and lower portions of the aquifer, and the design of the NoVOCs™ well. The study results indicated that significant biofouling and iron precipitation were occurring in the aquifer. Based on the study results, the developer has modified the NoVOCs™ well to include the injection of a biocide and chemical dispersant. During these studies, demonstration activities were placed on hold. If continuous well operation cannot be achieved by mid-December 1998, this technology demonstration will end.

Evaluation of Remediation by Natural Attenuation

Is natural attenuation working at NAS North Island?

Contamination of shallow soils and groundwater in the location of a former solid-waste disposal facility at NAS North Island has been put to the test. Working closely with Parsons Engineering Science, Inc., the Navy has been monitoring a 300-foot-wide by 500 foot-long plume of contaminated groundwater for approximately four quarters at NAS North Island.

Recent groundwater sampling results indicate a change in the concentrations of some target contaminants. Decreased concentrations of tetrachloroethene (PCE) and trichloroethene (TCE) have been observed. An increase in *cis*-1, 2-dichloroethene and vinyl chloride have also been observed during the sampling period. These results may indicate that natural attenuation by reductive dechlorination is occurring at this site. Natural attenuation is the natural process by which contaminants undergo biological degradation. The Navy will continue to monitor the success of natural attenuation as a remediation alternative in the environmental cleanup process at NAS North Island.

Bioslurping

Lessons learned at NAVSTA Mayport

The extraction wells in the former sludge drying bed at NAVSTA Mayport.

Bioslurping is a process in which free product, water, and air are extracted simultaneously via a single aboveground liquid ring vacuum pump (LRP). A LRP uses water to provide a seal between a rotating oblong-shaped impeller and the impeller housing. The tolerances between the impeller and housing are not tight because of the water seal. This arrangement allows the LRP to move liquid-phase fluids as well as air. During the bioslurp process, the vacuum produced by the LRP is applied to a drop tube that is placed in a standard soil vapor extraction well. The drop tube is open only at the bottom; the opening is placed at the top of the water table. All fluids (free product, water, and air) are then extracted by the drop tube and processed through the LRP. The air, water, and free product are separated afterward.

The bioslurp system at the North Tank Fuel Farm (NTFF) at a naval base neighboring NAVSTA Mayport is composed of 22 extraction wells, a 10-horsepower (hp) LRP, a water seal tank, an oil/water separator, a catalytic oxidizer, associated piping, transfer pumps, and process controls. The NTFF system became operational in April 1996 with only two extraction wells. The system was expanded to 22 wells in spring 1997. The target free product, JP-5, is collected on site in 55-gallon drums. The water is transferred via underground piping to the station's sewage treatment plant. The off-gas vapor is processed by the catalytic oxidizer and released to the atmosphere. The subsurface soils consist of very fine-grained sand interbedded with clayey sand. System operation was discontinued in March 1998. During its 23-month operational period, the NTFF bioslurper removed 7,238.5 gallons of hydrocarbons as vapor, 497 gallons as free product, and 7.2 gallons dissolved in water. The total volume of hydrocarbons removed was 7,742.7 gallons.

The bioslurp system at Solid Waste Management Unit (SWMU) 7, NAVSTA Mayport, consists of 121 extraction wells, two 20-hp LRPs, two water seal tanks, two 20,000-gallon storage tanks, a dehumidifier, an induced draft blower, three 1,000-pound carbon units, associated piping, transfer pumps, and process controls. The SWMU 7 bioslurping system came online in January 1998. The target free product at SWMU 7 is bilge oil. The use of carbon units for off-gas treatment was discontinued in June 1998 because of the low concentrations of hydrocarbons in the process gas. The dehumidifier and induced draft blower were not needed once the carbon units were disconnected. The dehumidifier was used to prolong the use of each carbon canister by reducing the amount of water vapor and hydrocarbons in the process gas. The induced draft blower was needed to push the process gas through the carbon units. The 20,000-gallon tanks, which existed before the bioslurping system was constructed, store the process liquids before they are transferred to the NAVSTA Mayport Oily Waste Treatment Plant (OWTP). The subsurface at the site is dredged fill material consisting of fine sand with scattered shell fragments. The SWMU 7 bioslurp system has been in operation for 7 months. In this time, the SWMU 7 bioslurper has removed 1,140.7 gallons of hydrocarbons dissolved in water, 550 gallons as free product, and 10.6 gallons as vapor. The total volume of hydrocarbons removed thus far is 1,701.3 gallons.

The total extraction system with the manifolds in the front.

The following lessons were learned at NTFF and applied at SWMU 7:

- The additional extraction wells at SWMU 7 greatly increase the area of influence of the system. These wells were installed by the NAS Jacksonville Site Characterization and Analysis Penetrometer System (SCAPS) rig at a greatly reduced time and cost as compared to normal well installation techniques.
- The larger and more numerous LRPs at SWMU 7 increase the vacuum at each wellhead, enhancing fluid recovery rates.
- The bioslurper at SWMU 7 is mounted on trailers, allowing easy transfer of the equipment to another location when the bioslurping is discontinued there.
- The dehumidifier at SWMU 7 removed from the process gas hundreds of gallons of water that would have coated the carbon, greatly reducing its efficiency.
- The SWMU 7 dehumidifier also greatly reduced the amount of hydrocarbon loading into the carbon units. This reduction was verified by pre- and post-dehumidifier process gas sampling.
- Liquid collection pumps were added to the process gas piping at SWMU 7. The process gas piping at NTFF filled with condensed liquid on a regular basis, reducing LRP efficiencies.
- The process control equipment at NTFF was very susceptible to damage from a fluctuating power supply provided by the naval station's power grid. Process equipment that is less susceptible to power fluctuations was selected for SWMU 7.
- The lesser amount of free product recovered at NTFF is due to the relatively finer-grained subsurface soils present there. Fine-grained materials impede the movement of free product more than the movement of other fluids, such as water or vapor.

Oxygen-Releasing Compounds

NAVSTA Mayport requests demonstration at SWMU 14

Aerobic bioremediation has been shown to be an effective method of remediation at sites with organic contaminants. Usually, the limiting factor in aerobic bioremediation is oxygen. The microorganisms, nutrients, and moisture are typically present, but most sites are oxygen-deficient. The addition of oxygen significantly increases the remediation rate, typically by one or two orders of magnitude.

Oxygen-releasing compounds (ORCs) are solid forms of magnesium peroxide or calcium peroxide. When they are hydrated, these compounds are capable of slow and sustained release of molecular oxygen into groundwater. ORCs slowly release the appropriate amount of oxygen into the groundwater to sustain aerobic activity. Biofouling is inhibited by an elevated, but localized, pH. The residual product after the oxygen is released is milk of magnesia. ORCs usually require 6 months to completely hydrate. They can be introduced to an aquifer either as a slurry in direct-push bore-holes or as "socks" in conventional monitoring wells. Compared to conventional methods of increasing oxygen concentrations in an aquifer, use of ORCs results in a reduction in operations and maintenance costs.

The NAVSTA Mayport Partnering Team has requested a demonstration of ORC technology at Solid Waste Management Unit (SWMU) 14 to evaluate the technology's impact on the natural attenuation of semivolatile organic materials. The contamination at SWMU 14 resulted from former firefighting training operations. Monitoring well samples have indicated high concentrations of naphthalene, phenanthrene, 2-methylnaphthalene, and total organic carbon. The demonstration area is a 50-foot by 30-foot area near an abandoned concrete fire mat. This demonstration is an interim measure. The ORCs will be inserted via direct-push bore-holes, which will then be grouted back after ORC placement. The site will be monitored for 10 months following ORC placement.

Electronic IR Reports

PDF files reduce paper use

To support goals for a "paperless" Navy by 2000, the Navy is taking steps to create electronic versions of reports produced under the Installation Restoration (IR) Program. Recently, Naval Facilities Engineering Command Southwest Division (SWDIV) created several electronic reports using Adobe Acrobat® software. Adobe Acrobat® produces portable document format (PDF) files that are fully searchable and retain their entire original layout, including fonts, images, and tables. Hypertext links within a document can also be created using Adobe Acrobat®, making documents easy to use and navigate. PDF files are compact and cross-platform, and can be viewed by any user using Adobe Acrobat® Reader software, which allows a user to view and search PDF files only. Adobe Acrobat® Reader can be obtained for free from the Internet at http://www.adobe.com/prodindex/acrobat/readstep.html.

Publishing documents electronically reduces paper use and enables documents to be transferred via CD-ROM, e-mail, or the Internet. Currently, some Navy documents are distributed on CD-ROM, along with a hard copy of the report. Future reports will primarily be produced and transferred electronically. SWDIV submitted the first completely electronic deliverable on CD-ROM for regulatory review in August 1998. Since then, documents have been submitted for regulatory and public review on a CD-ROM, minimizing the labor needed to maintain and copy reports. The entire Administrative Record for the NAS North Island IR Program has been converted to PDF files, condensing numerous shelves of reports to seven CD-ROMs. Although initial costs are incurred to convert documents to PDF files, reproduction costs are greatly reduced. In the future, IR documents may be made available on the Internet, increasing public access to IR documents.

For more information on this project, contact Mr. Richard G. Mach Jr., Coronado Complex RPM, SOUTHWESTDIVNAVFACENGCOM, at 619-556-9934 or e-mail rgmach@efdswest.navfac.navy.mil.

Pilot TAPP Program

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The pilot TAPP program at NAS North Island is an example of the Navy's leadership in building community acceptance and taking the necessary steps to give communities the information they need to evaluate Navy cleanup goals and the effectiveness of complex cleanup technologies.

Further information on the DoD TAPP program can be found on the Internet at http://www/dtic.mil/envirodod/rab/. For details on the NAS North Island pilot TAPP project, contact Mr. William Collins, Lead Coronado Complex RPM, SOUTHWESTDIVNAVFACENGCOM at (619) 556-9901 or e-mail wecollins@efdswest.navfac.navy.mil.

For questions or comments, visit the NELP website at http://nelp.navy.mil or contact Ursula Shaw (NAVSTA Mayport NELP Coordinator) by phone at (904) 249-6730 (DSN 960) or e-mail at nuns1@navtap.navy.mil or Mike Magee (Navy Region Southwest/ NAS North Island NELP Coordinator) by phone at (619) 524-6357 or e-mail at Magee.Mike.H@cnrasw.nasni.navy.mil.

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